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Correlates of Posttraumatic Stress Disorder Symptoms in Marines Back From War

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The effect of combat and operational stress on the mental health of military personnel is a major concern. The objective of this study was to identify factors associated with possible posttraumatic stress disorder (PTSD). A questionnaire was completed by 1,569 Marines who deployed in support of conflicts in Iraq and Afghanistan (2002–2007). Using the PTSD Checklist with a cutoff score of 44, 17.1% of the sample screened positive for possible PTSD. Of 9 demographic and psychosocial factors examined in relation to PTSD, 4 were significant in a multivariate analysis: deployment-related stressors, combat exposure, marital status, and education. Deployment-related stressors had a stronger association with PTSD than any other variable. This is an important finding because deployment-related stressors are potentially modifiable.

The effect of combat on the mental health of military personnel is a major concern among the public, military leaders, and policy makers. Psychological disorders in military populations have a pervasive impact on readiness and the accomplishment of military goals (Hoge et al., 2002). Specific characteristics of the current American operations in Iraq and Afghanistan, such as unclear enemy lines and the use of improvised explosive devices (IEDs) and roadside bombs, can place great psychological strain on combatants.

Military personnel who have deployed to combat zones have increased rates of mental disorders, including posttraumatic stress disorder (PTSD; Hoge et al., 2004; Hoge, Auchterlonie, Milliken, 2006; Smith et al., 2008). Posttraumatic stress disorder is the disorder most clearly linked with combat exposure (Dohrenwend et al., 2007; Hoge et al., 2004; Larson, Highfill-McRoy, &

Booth-Kewley, 2008), but more research is needed to determine its key risk factors among military personnel deployed to combat zones. In addition, more research is needed to determine modifiable factors in the combat deployment environment that might reduce the risk of PTSD.

A number of studies have found associations between combat exposure and PTSD diagnoses or symptoms. Studies conducted with Vietnam veterans, for example, found substantial relationships between combat exposure and PTSD (Dohrenwend et al., 2007; Fontana & Rosenheck, 1999; Koenen et al., 2003). Similar results have been observed for veterans of the Gulf War (Adler, Vaitkus, & Martin, 1996; Southwick et al., 1995; Wolfe, Brown, & Kelley, 1993). There is less evidence of this association for the current conflicts in Iraq and Afghanistan, although evidence is beginning to emerge, for U.S. (Hoge et al., 2004; Smith

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et al., 2008) and British military service members (Iversen et al., 2008).

Although combat exposure is typically considered the paramount stressor of war, a number of investigators have emphasized the importance of general military deployment stressors (Bartone, Vaitkus, & Adler, 1998; King, King, Gudanowski, & Vreven, 1995; Litz, King, King, Orsillo & Friedman, 1997). Noncombat stressors have been labeled in various ways, including deployment-related stressors, operational stressors, low-magnitude stressors, contextual stressors, and malevolent environment (Engelhard & van den Hout, 2007; King et al., 1995; Litz et al., 1997). Examples of these deployment-related stressors include excessive heat and cold, concerns or problems with family members back home, boredom, lack of privacy, problems with supervisors, and inadequate availability of supplies or equipment.

Most of the early data demonstrating the impact of deployment-related stressors on the mental health of service members came from studies of U.S. military peacekeepers (Bartone et al., 1998; Litz, Orsillo, Friedman, Ehlich, & Batres, 1997), not military combatants. However, evidence for the linkage between deployment-related stressors and mental disorders (including PTSD) has been found among Vietnam veterans (Fontana & Rosenheck, 1999; King et al., 1995), and Gulf War veterans (Vogt, Pless, King, & King, 2005). Only one study, to our knowledge, has investigated this association for the current conflicts in Iraq and Afghanistan (Engelhard & van den Hout, 2007). In this recent study of Dutch Army service members deployed to Iraq, deployment-related stressors were significantly related to PTSD (Engelhard & van den Hout, 2007).

Another factor that may be related to PTSD among combat-deployed military personnel is active duty versus reserve status. It has been suggested that reservists may be at increased risk for mental health problems after combat deployment because they reenter society without the fellowship of other military members who have shared their experiences or because military deployment is more disruptive to home life for reservists. There is some evidence that reservists who deploy to combat have more mental disorders compared with their active-duty counterparts (Browne et al., 2007; Milliken, Auchterlonie, & Hoge, 2007), but other studies have failed to find a difference between the two groups (Mental Health Advisory Team, 2008; Vogt, Samper, King, King, & Martin, 2008).

In addition to the variables described above, a number of standard demographic variables were assessed in this study to allow for statistical control of these variables in the analyses.

The objective of this study was to identify factors associated with possible PTSD in 1,569 Marines who deployed to combat zones in Iraq and Afghanistan. Based on evidence that level of combat exposure and general deployment-related stressors may be important risk factors for PTSD, extensive measures of combat experiences and deployment-related stressors were included.

METHOD

Participants

The study population consisted of 1,569 enlisted and officer Marines who had completed at least one war-zone deployment (e.g., Iraq, Afghanistan). The majority of the participants (95%) had been deployed to Iraq. Study participants were drawn from U.S. military bases located in southern California ($n = 851$) and Okinawa, Japan ($n = 718$). The U.S. Marines surveyed were assigned to a wide variety of units, including the 1st Marine Regiment (Camp Pendleton, California), 4th Marine Regiment (Camp Schwab, Okinawa), 7th Engineer Support Battalion (Camp Pendleton), and 9th Engineer Support Battalion (Camp Hansen, Okinawa). Participants came from a wide range of occupational categories; the most common were: infantry (15%), communications (13%), and motor transport (12%).

Every participant in the sample had been deployed to a combat zone between 2002 and 2007. Most (94%) had completed their most recent combat deployment between January 2004 and December 2007. Fifty-four percent of the participants had completed one combat deployment, 28.4% had completed two deployments, and 17.6% had completed three or more. Participants were asked to answer all survey questions with their most recent combat deployment in mind.

Measures

The PTSD Checklist (PCL; Weathers, Litz, Herman, Huska, & Keane, 1993) was used to assess posttraumatic stress symptoms. This is the most widely used measure of PTSD in studies of military personnel. This validated measure contains 17 items corresponding to symptom criteria for PTSD. Respondents rate each item using a 5-point scale (1 = *not at all* to 5 = *extremely*). The coefficient alpha for the present sample was .95, indicating good internal consistency. The military and civilian versions of the PCL contain identical items; the only difference is that the civilian version of the PCL (PCL-C) instructs participants to respond to the list of items with their general life experiences in mind (which can include deployments), whereas the military version (PCL-M) asks participants to respond with only their stressful military experiences in mind. Consistent with most research on military samples, we chose to use the PCL-C because we wanted to gauge participants' reactions to their overall life stressors, both military and nonmilitary.

There are two common methods for scoring the PCL, the overall cutoff score method and the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)* (American Psychiatric Association, 1994) method. For the overall cutoff score method, a total score is obtained by summing the responses to each of the 17 items. Different cutoff scores have been recommended, but a widely used cutoff for possible PTSD is a score of 44. Although the originators of the scale used a cutoff of 50 (Weathers et al.,

1993), other researchers have recommended using lower cutoff scores (Bliese et al., 2008; Cook, Elhai, & Arian, 2005). Bliese et al. (2008) provided evidence for the use of cutoffs lower than 50 for active duty military screening settings. A number of researchers have recommended using a PCL cutoff of 44 (Blanchard, Jones-Alexander, Buckley & Forneris, 1996; Ruggiero, Del Ben, Scotti, & Rabalais, 2003). Based on this evidence, we opted to score the PCL using a cutoff of 44 ($PCL \geq 44$). A second method for scoring the PCL follows the *DSM-IV* criteria. To meet PTSD criteria using the *DSM-IV* method, a subject must have at least one intrusion symptom, three avoidance symptoms, and two hyperarousal symptoms, each present at a level of moderate or higher during the previous month. We scored our PCL data using both methods, but most analyses were based on the overall cutoff score method ($PCL \geq 44$).

A combat exposure scale was adapted from the Army Mental Health Advisory Team combat exposure scale (MHAT, 2008). The combat exposure scale consisted of 16 items assessing experiences, such as "receiving incoming artillery, rocket or mortar fire" and "knowing someone seriously injured or killed." Participants were asked to indicate how often they experienced each combat stressor using a 5-point scale (1 = *never* to 5 = *10 or more times*). The scale's coefficient alpha for the present sample was .92. An overall combat exposure score was created by summing across all scale items. Level of combat exposure was classified into four groups (low, medium, high, very high) based on the quartile distribution of the combat exposure scale scores.

A deployment-related stressor scale was constructed for the purposes of this study. This scale consisted of 11 questions about stressors Marines might experience during deployment, such as "concerns or problems back home," "problems with supervisor(s) or chain of command," and "lack of time off." It was adapted from similar instruments used by other military researchers (Mental Health Advisory Team, 2008; Wright et al., 1995). Respondents were asked "how much trouble or concern" was caused by each deployment stressor (1 = *very low concern* to 5 = *very high concern*). The coefficient alpha for the present sample was .88. An overall deployment-related stressor score was created by summing across all scale items. Deployment stressor level was classified into four groups (low, medium, high, very high) based on the quartile distribution of the deployment stressor scale scores.

The questionnaire asked for the following demographic and military information: sex, age, marital status, rank/pay grade, military occupational specialty, education level, ethnic background, active versus reserve status, and whether the participant had deployed as an individual augmentee. Respondents were also asked to provide additional information about their combat deployments (e.g., locations).

Procedure

Military personnel at U.S. Marine Corps bases located in southern California and Okinawa, Japan were invited by the researchers to

participate in the study. Participation was voluntary and military unit commanders were not present during enrollment or questionnaire completion. Study enrollment and survey administration was performed by civilian researchers. To be eligible for participation, respondents had to be members of the Marine Corps, and had to have completed at least one combat deployment. Each participant was given a small gift (either a \$5 fast food gift card or a computer flash drive of comparable value) in exchange for participation. The overall response rate was 78%.

Participants were asked to complete a questionnaire (called the Warfighter Status Survey) lasting about 30 minutes. After receiving an explanation of the study aims and procedures, all participants gave written informed consent prior to participation. The questionnaire was administered to participants in group settings at military bases located in southern California and Okinawa, Japan. Questionnaires were completed between June 2007 and January 2008.

The survey was not anonymous. To allow for a possible follow-up assessment, participants were asked to provide their social security numbers and names. Potential participants were assured that all data would be kept completely confidential and no one in their chain of command would ever see their data. All research procedures were approved by the Naval Health Research Center Institutional Review Board.

Data Analysis

Univariate and multivariate logistic regression were used to assess the associations between the exposure variables and screening positive for PTSD. A series of univariate logistic regressions were performed to determine the odds ratios (ORs) and 95% confidence intervals (CIs) for each variable of interest. In some cases, item-level analyses were also conducted. For the multivariate analysis, all demographic variables and all covariates that were significant in the univariate analysis were entered into the model. Regression diagnostics were used to evaluate pairwise correlations and variance inflation factors. These did not reveal any substantial collinearity among the variables. Statistical significance was set at $p < .05$ (two-sided) for all analyses. Statistical analyses were performed using SPSS for Windows, version 16 (SPSS Inc., 2008).

RESULTS

The demographic characteristics of the participants are shown in Table 1. The participants were mostly men. The main ethnic groups were White and Hispanic. About half the sample had a high school diploma or equivalency degree or a lower level of education; the other half had some college or a college degree. Over a third of the sample were aged 21 years or younger. The most common pay grades were E4–E6. About half of the participants were married. The study sample was generally comparable to the Marine Corps population on demographics, except that Hispanics were overrepresented in the study sample and Marines in the lowest

Table 1. Demographic Characteristics of Study Participants, Marines Deployed to Combat, 2002–2007, $N = 1,569$

Demographic characteristic	<i>n</i>	%
Sex		
Men	1,490	95.0
Women	79	5.0
Race/ethnicity		
White, non-Hispanic	904	57.6
Black, non-Hispanic	178	11.3
Hispanic	351	22.4
Other	136	8.7
Education		
High school or less	756	48.2
Some college or college degree	813	51.8
Age (years)		
18–21	593	37.8
22–26	487	31.0
≥27	489	31.2
Marital status		
Never married	726	46.3
Married	727	46.3
Divorced	116	7.4
Pay grade/rank		
Enlisted		
E1–E3 (Private–Lance Corporal)	375	23.9
E4–E6 (Corporal–Staff Sergeant)	896	57.1
E7–E9 (Gunnery Sergeant–Sergeant Major)	158	10.0
Warrant Officer		
W1–W5	39	2.5
Officer		
O1–O3 (Second Lieutenant–Captain)	76	4.9
O4–O6 (Major and above)	25	1.6
Active or reserve		
Active	1,312	83.6
Reserve	257	16.4
Combat deployments		
1	848	54.0
2	445	28.4
≥3	276	17.6

pay grade categories (E1–E3) were somewhat underrepresented in the study sample.

Pearson correlations between the key variables in the study are shown in Table 2. Although the bivariate correlations revealed a number of significant associations among the study variables, none of these surpassed the level of acceptable multicollinearity for independent variables in multivariate logistic regression analyses.

Two hundred sixty-nine respondents (17.1%) screened positive for possible PTSD (PCL ≥ 44). The terms “possible PTSD”

and “screened positive for PTSD” are used interchangeably to refer to individuals who scored ≥44 on the PCL. Both overall deployment-related stressors and overall combat exposure were strongly and significantly associated with possible PTSD in the univariate analysis (Table 3). Three of the demographic variables had significant associations with possible PTSD: age, education, and marital status. Marines in the youngest age category (18–21 years) were at the greatest risk for screening positive for PTSD, followed by Marines in the middle age category (22–26 years); both of these groups were more likely to screen positive for PTSD than older Marines (≥27 years). Marines with more education (some college or college degree) were less likely to screen positive for PTSD than were their less-educated counterparts. On marital status, divorced Marines were at the highest risk for PTSD, followed by never-married Marines. Married Marines were at the lowest risk for screening positive for PTSD. No association was found between active duty versus reserve status and screening positive for PTSD.

Univariate logistic regression was used to assess the associations between the individual deployment-related stressor items and screening positive for PTSD. These results are shown in Table 4. Every individual deployment-related stressor was significantly associated with possible PTSD. The deployment-related stressors that had the strongest associations with screening positive for PTSD were concerns or problems back home, problems with supervisor(s) or chain of command, and lack of privacy or personal space.

The associations between the combat exposure scale items and screening positive for PTSD were also assessed using univariate logistic regression; these results are presented in Table 5. Every combat exposure item was significantly associated with possible PTSD. The combat exposure items that had the strongest associations with screening positive for PTSD were “Feeling I could be killed at any time,” “IED/booby trap exploding near you,” and “Having hostile reactions from civilians.” Combat exposure items relating to attacking or killing the enemy (“Firing at the enemy” and “Being responsible for the death of an enemy combatant”) had smaller associations with possible PTSD than the other combat exposure items.

In the final multivariate logistic regression model, the following variables emerged as significant in relation to possible PTSD: deployment-related stressor scale, combat exposure scale, marital status, and education (Table 6). The variable with the strongest association with possible PTSD was the deployment-related stressor scale. With all other variables controlled for, Marines in the highest quartile of deployment-related stressors were more than nine times as likely to screen positive for PTSD as those in the lowest quartile.

The interaction between the deployment-related stressors scale and the combat exposure scale was examined and was nonsignificant. The interactions between the individual deployment-related stressors scale items and the combat exposure scale were also assessed and all were nonsignificant.

Table 2. Pearson Correlations Between Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Combat exposure	–											
2. Deployment-related stressors	.25**	–										
3. Age	.00	–.11**	–									
4. Education	.00	–.09**	.41**	–								
5. Race	–.06*	.02	.01	–.08**	–							
6. Married	.02	–.04	.49**	.18**	–.03	–						
7. Never married	–.04	.00	–.51**	–.16**	.02	–.86**	–					
8. Divorced	.04	.06*	.04	–.03	.00	–.26**	–.26**	–				
9. Number of deployments	.07**	.00	.46**	.17**	–.02	.24**	–.30**	.13**	–			
10. Deployment status ^a	.02	.07**	–.02	–.05	.01	–.01	–.02	.06*	.03	–		
11. Active or reserve	–.06*	–.02	–.11**	–.27**	–.13**	.03	–.02	–.02	.01	–.05*	–	
12. PCL	.37**	.44**	–.14**	–.10**	.02	–.09**	.05	.08**	.03	.00	–.03	–

Note. Race is coded as White (1) or non-White (2). Marital status is coded as married (1), never married (2), or divorced (3). Deployment status is coded as individual augmentee (1) or member of a deployed unit (2). Active or reserve is coded as active (1) or reserve (2). PCL = PTSD Checklist.

^aMember of a deployed unit versus individual augmentee.

* $p < .05$. ** $p < .001$.

Scores on the combat exposure scale also had a strong and significant association with possible PTSD. Controlling for all other variables, Marines in the highest quartile of combat exposure were more than four and a half times as likely to screen positive for PTSD as those in the lowest quartile.

The two demographic variables that were significant in the multivariate model were marital status and education. Marines who had been divorced were over twice as likely to screen positive for PTSD as married Marines. Marines with more education (some college or college degree) were less likely to screen positive for PTSD than were their less-educated counterparts. No other associations between demographic variables and PTSD were found.

The data were also reanalyzed using the *DSM-IV* method of scoring the PCL. The results of both the univariate and multivariate logistic regression analyses were similar using the *DSM-IV* method. The only difference in the multivariate results was that when the *DSM-IV* scoring method was used, both divorced ($OR = 1.86$; 95% $CI = 1.10, 3.15$) and never-married Marines ($OR = 1.48$; 95% $CI = 1.04, 2.11$) were at significantly higher risk for possible PTSD compared with married Marines. The results for all other variables were essentially the same.

DISCUSSION

The objective of this study was to identify factors associated with PTSD in U.S. Marines who deployed to combat in support of the current conflicts in Iraq and Afghanistan. In our sample of 1,569 Marines, 17.1% screened positive for possible PTSD ($PCL \geq 44$). Of the nine demographic and psychosocial factors

that were examined in relation to PTSD, four factors emerged as significant in the multivariate model: deployment-related stressors, combat exposure, marital status, and education.

The one variable in the study that had the strongest association with screening positive for PTSD was deployment-related stressors. In fact, this category of noncombat stressors was more strongly associated with possible PTSD than was combat exposure. Deployment-related stressors are stressors associated with the military deployment itself, but not directly related to combat. They include concerns or problems back home, difficulties in communicating with home, problems with leadership, long deployments, and lack of time off. In the present study, the deployment-related stressors that were the most strongly linked with possible PTSD were those related to family concerns and leadership issues. Clearly, these are very important issues for deployed Marines. Future research should more comprehensively examine the impact of these specific types of stressors on the mental health of deployed military personnel.

From a broader perspective, this study's results regarding deployment-related stressors, which are consistent with research on Vietnam veterans (Fontana & Rosenheck, 1999; King et al., 1995), are important for two reasons. First, the results confirm the intriguing finding that deployment-related stressors, unrelated to combat, may have a powerful impact on the mental health of deployed personnel. This is consistent with other research showing that chronic stress can exacerbate responses to acute stress (Norris & Uhl, 1993). Second, because deployment-related stressors are potentially modifiable, the military may be able to address them in a variety of ways, such as by improving support

Table 3. Univariate Logistic Regression Analysis of Demographic and Psychosocial Variables in Relation to Possible Posttraumatic Stress Disorder, Marines Deployed to Combat, 2002–2007

Variable	N	OR	95% CI
Combat exposure			
Low (reference)	395	1.00	
Medium	391	1.86*	1.13–3.06
High	400	2.89**	1.81–4.62
Very high	379	6.71**	4.30–10.47
Deployment-related stressors			
Low (reference)	375	1.00	
Medium	368	3.05**	1.69–5.51
High	417	4.45**	2.53–7.82
Very high	387	12.16**	7.07–20.91
Age (years)			
18–21	593	1.78**	1.27–2.49
22–26	487	1.55*	1.09–2.21
≥27(reference)	489	1.00	
Education			
High school or less (reference)	756	1.00	
Some college or college degree	813	0.64**	0.49–0.84
Race			
White (reference)	904	1.00	
Nonwhite	665	1.27	0.97–1.65
Marital status			
Married (reference)	726	1.00	
Never married	727	1.46**	1.10–1.93
Divorced	116	2.63**	1.67–4.13
Number of deployments			
1 (reference)	848	1.00	
≥2	721	1.14	0.88–1.49
Deployment status			
Member of a deployed unit (reference)	1,321	1.00	
Individual augmentee	248	1.02	0.71–1.45
Active or reserve			
Active (reference)	1,312	1.00	
Reserve	257	1.32	0.94–1.84

* $p < .05$. ** $p < .01$.

to families back home, improving access and options for communicating with home, shortening deployments, and providing combatants with more time off while in theater. In addition, the military could develop predeployment training for Marines to help them become desensitized to, and cope more effectively with these stressors. Currently, the Marine Corps Combat Operational Stress Control program is developing programs aimed at providing additional support to families of deployed members. In addition, the Marine Corps has started actively to educate small-unit lead-

Table 4. Univariate Logistic Regression Analysis of Deployment-Related Stressor Scale Items in Relation to Possible PTSD, Marines Deployed to Combat, 2002–2007^a

	n	OR	95% CI
Uncertain redeployment date			
Low concern	1,307	1.00	
High concern	256	2.86**	2.11–3.88
Long deployment length			
Low concern	1,266	1.00	
High concern	297	3.11**	2.32–4.15
Feeling homesick			
Low concern	1,203	1.00	
High concern	361	2.51**	1.90–3.33
Lack of privacy or personal space			
Low concern	1,167	1.00	
High concern	395	3.13**	2.37–4.11
Boredom or monotony			
Low concern	1,050	1.00	
High concern	511	2.57**	1.96–3.36
Concerns or problems back home			
Low concern	1,187	1.00	
High concern	375	3.30**	2.50–4.36
Problems with supervisor(s) or chain of command			
Low concern	1,275	1.00	
High concern	286	3.19**	2.38–4.28
Lack of time off			
Low concern	1,160	1.00	
High concern	401	2.86**	2.17–3.77
Heat and/or cold			
Low concern	1,056	1.00	
High concern	504	2.79**	2.13–3.65
Not having right equipment or parts			
Low concern	1,219	1.00	
High concern	342	2.81**	2.12–3.73
Difficulty in communicating with home			
Low concern	1,325	1.00	
High concern	236	3.04**	2.23–4.15

^aRespondents were asked “how much personal trouble or concern” was caused by each deployment stressor. Responses of *very low*, *low*, and *medium* were categorized as low concern (0); responses of *high* and *very high* were categorized as high concern (1).

** $p < .01$.

ers on the importance of combat stress control during and after deployment, and the value of family support.

An additional key finding was the positive association between combat exposure intensity and possible PTSD. This is not surprising; one would expect Marines who experience more combat trauma to report a higher level of PTSD symptomatology. These results are consistent with a number of past studies (Fontana & Rosenheck, 1999; Hoge et al., 2004; Iversen et al., 2008), and

Table 5. Univariate Logistic Regression Analysis of Combat Exposure Scale Items in Relation to Possible PTSD, Marines Deployed to Combat, 2002–2007^a

	<i>n</i>	OR	95% CI
Receiving incoming artillery, rocket, or mortar fire			
Never	248	1.00	
1 or more times	1,320	2.13**	1.37–3.31
Seeing destroyed homes or villages			
Never	458	1.00	
1 or more times	1,110	2.63**	1.85–3.74
Being shot at or receiving small arms fire			
Never	705	1.00	
1 or more times	862	2.60**	1.95–3.48
Handling or uncovering human remains			
Never	1,088	1.00	
1 or more times	480	2.54**	1.94–3.32
Seeing dead or seriously dead Americans			
Never	742	1.00	
1 or more times	826	2.67**	2.01–3.56
Having hostile reactions from civilians			
Never	827	1.00	
1 or more times	741	2.88**	2.18–3.81
IED/booby trap exploding near you			
Never	896	1.00	
1 or more times	672	3.00**	2.28–3.95
Being attacked or ambushed			
Never	1,005	1.00	
1 or more times	562	2.47**	1.89–3.23
Knowing someone seriously injured or killed			
Never	407	1.00	
1 or more times	1161	1.65**	1.45–1.87
Firing at the enemy			
Never	1,110	1.00	
1 or more times	457	1.43**	1.30–1.57
Being responsible for death of an enemy combatant			
Never	1,331	1.00	
1 or more times	236	1.40**	1.23–1.60
Seeing enemy forces wounded, killed or dead			
Never	906	1.00	
1 or more times	662	2.42**	1.85–3.17
Seeing civilian males wounded, killed or dead			
Never	1,002	1.00	
1 or more times	566	2.31**	1.77–3.01
Seeing civilian females wounded, killed or dead			
Never	1,315	1.00	
1 or more times	253	2.69**	1.98–3.65
Seeing civilian children wounded, killed or dead			
Never	1,273	1.00	
1 or more times	295	2.62**	1.95–3.52
Feeling I could be killed at any time			
Never	365	1.00	
1 or more times	1,203	3.82**	2.45–5.96

Note. IED = improvised explosive device.

^aRespondents were asked “How often did you experience each of the follow combat stressors during your most recent deployment?” Responses ranged from *never* to *10 times or more*. For analysis purposes, responses were dichotomized (0 or 1) to contrast those who never experienced the exposure with those who experienced at least once.

***p* < .01.

Table 6. Multivariate Logistic Regression Analysis of Demographic and Psychosocial Variables in Relation to Possible Posttraumatic Stress Disorder, Marines Deployed to Combat, 2002–2007

Variable	OR ^a	95% CI
Combat exposure		
Low (reference)	1.00	
Medium	1.34	0.79–2.26
High	2.03**	1.24–3.33
Very high	4.62**	2.88–7.42
Deployment-related stressors		
Low (reference)	1.00	
Medium	2.86**	1.56–5.24
High	3.90**	2.18–6.97
Very high	9.21**	5.24–16.20
Age (years)		
18–21	1.38	0.86–2.23
22–26	1.30	0.86–1.97
≥27 (reference)	1.00	
Education		
High school or less (reference)	1.00	
Some college or college degree	0.69*	0.49–0.96
Race		
White (reference)	1.00	
Non-White	1.31	0.97–1.76
Marital status		
Married (reference)	1.00	
Never married	1.32	0.93–1.88
Divorced	2.34**	1.41–3.89
Number of deployments		
1 (reference)	1.00	
≥2	1.35	0.98–1.86
Deployment status		
Member of a deployed unit (reference)	1.00	
Individual augmentee	1.43	0.96–2.13
Active or reserve		
Active (reference)	1.00	
Reserve	1.44	0.96–2.15

^aOdds ratios were adjusted for all covariates shown in the table.

* $p < .05$. ** $p < .01$.

support the idea of a dose-response relationship between combat exposure and PTSD symptoms. In the present study, combat exposure had a significant relationship with PTSD, even with all other variables controlled.

Marital status had a significant association with possible PTSD. Marines sent to war were at substantially higher risk for possible PTSD if they were divorced than if they were currently married or never married. This finding is consistent with past military (Smith et al., 2008) and civilian research (Simon, 2002). In addition,

education was significantly associated with possible PTSD in this sample: Marines with more education were less likely to screen positive for PTSD than were those with less education. This protective effect of education has been found in previous military research (Sutker, Davis, Uddo, & Ditta, 1995).

The hypothesis that PTSD rates would be higher for reserve than for active-duty personnel was not supported. Although the rate of possible PTSD for reservists (20.6%) was somewhat higher than for active-duty personnel (16.5%), this difference was not significant. It should be noted that more than 90% of the reservists in our sample deployed with the unit that they had been drilling and training with on a routine basis, and not as individual augmentees, who deploy individually to other units. Because they drilled and trained together on a monthly basis both before and after deployment, most reservists in our study had the opportunity to maintain social ties with the individuals with whom they deployed.

Although this study's finding regarding the possible importance of deployment-related stressors is interesting, it needs to be interpreted cautiously because of the cross-sectional nature of our study. Based on the present data it is not possible to demonstrate that deployment-related stressors truly had a causal impact on the Marines' mental health. It is possible that the state of the Marines' mental health, their level of neuroticism, or other prior vulnerabilities could have affected their reporting of, or sensitivity to, deployment-related stressors. Prospective studies examining deployment-related stressors in relation to mental health will be needed to untangle these associations. Inclusion of neuroticism or negative affect in these studies would be very helpful.

This study had a number of limitations. Because of the small number of women and personnel who deployed to Afghanistan in our study, we were unable to conduct separate statistical analyses for these groups. These groups may have unique risk factors for PTSD, and should be examined more closely in future research. Another limitation relates to the anchoring of PTSD symptoms to combat experiences. Some of the Marines' symptoms could have been the result of noncombat experiences, but because we did not have data on time of onset of PTSD symptoms, we were not able to document this. Another important limitation of the study was that because it was cross-sectional, all conclusions about cause and effect are speculative. In general, the psychosocial factors that emerged as risk factors for possible PTSD (self-reported combat exposure and deployment-related stressors) could partly be manifestations of respondents' mental disorders, although this issue remains controversial (Dohrenwend et al., 2007). An additional limitation is that all data for the study were based on self-report, with all of its associated limitations (e.g., socially desirable responding). In addition, the surveys from which we drew our data asked for identifying information. Although confidentiality of responses was emphasized, it is likely that some degree of underreporting occurred.

A potentially modifiable variable, deployment-related stressors, was more strongly linked with possible PTSD than any other

variable. Additional research should aim to clarify the nature and impact of deployment-related stressors, especially those related to leadership issues and family concerns. Military leaders and policy makers should continue developing programs and taking steps to modify and lessen the impact of deployment-related stressors because this could have a crucial impact on the mental health of deployed military personnel.

REFERENCES

- Adler, A. B., Vaitkus, M. A., & Martin, J. A. (1996). Combat exposure and posttraumatic stress symptomatology among U.S. soldiers deployed to the Gulf War. *Military Psychology*, 8, 1–14.
- American Psychiatric Association. (1994). *Diagnostic and statistical manual for mental disorders* (4th ed.). Washington, DC: Author.
- Bartone P. T., Vaitkus, M. A., & Adler, A. B. (1998). Dimensions of psychological stress in peacekeeping operations. *Military Medicine*, 163, 587–593.
- Blanchard, E. B., Jones-Alexander, J., Buckley, T. C., & Forneris, C. A. (1996). Psychometric properties of the PTSD checklist (PCL). *Behaviour Research and Therapy*, 34, 669–673.
- Bliese, P. D., Wright, K. M., Adler, A. B., Cabrera, O., Castro, C. A., & Hoge, C. W. (2008). Validating the Primary Care Posttraumatic Stress Disorder Screen and the Posttraumatic Stress Disorder Checklist with soldiers returning from combat. *Journal of Consulting and Clinical Psychology*, 76, 272–281.
- Browne, T., Hull, L., Horn, O., Jones, M., Murphy, D., Fear, N. T., et al. (2007). Explanations for the increase in mental health problems in UK reserve forces who have served in Iraq. *British Journal of Psychiatry*, 190, 484–489.
- Cook, J. M., Elhai, J. D., & Acrean, P. A. (2005). Psychometric properties of the PTSD Checklist with older primary care patients. *Journal of Traumatic Stress*, 18, 371–276.
- Dohrenwend, B. P., Turner, J. B., Turse, N. A., Adams, B. G., Koenen, K. C., & Marshall, R. (2007). Continuing controversy over the psychological risks of Vietnam for U.S. veterans. *Journal of Traumatic Stress*, 20, 449–465.
- Engelhard, I. M., & van den Hout, M. A. (2007). Preexisting neuroticism, subjective stressor severity, and posttraumatic stress in soldiers deployed to Iraq. *Canadian Journal of Psychiatry*, 52, 505–509.
- Fontana, A., & Rosenheck, R. (1999). A model of war zone stressors and posttraumatic stress disorder. *Journal of Traumatic Stress*, 12, 111–126.
- Hoge, C. W., Auchterlonie, J. L., & Milliken, C. S. (2006). Mental health problems, use of mental health services, and attrition from military service after returning from deployment to Iraq or Afghanistan. *Journal of the American Medical Association*, 295, 1023–1032.
- Hoge, C. W., Castro, C. A., Messer, S. C., McGurk, D. M., Cotting, D. I., & Koffman, R. L. (2004). Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *New England Journal of Medicine*, 351, 13–22.
- Hoge, C. W., Lesikar, S. E., Guevara, R., Lange, J., Brundage, J. F., Engel, C. C., et al. (2002). Mental disorders among U.S. military personnel in the 1990s: Association with high levels of health care utilization and early military attrition. *American Journal of Psychiatry*, 159, 1576–1583.
- Iversen, A. C., Fear, N. T., Ehlers, A., Hacker, H. J., Hull, L., Earnshaw, M., et al. (2008). Risk factors for post-traumatic stress disorder among UK Armed Forces personnel. *Psychological Medicine*, 38, 511–522.
- King, D. W., King, L. A., Gudanowski, D. M., & Vreven, D. L. (1995). Alternative representations of war zone stressors: Relationships to posttraumatic stress disorder in male and female Vietnam veterans. *Journal of Abnormal Psychology*, 104, 184–196.
- Koenen, K. C., Stellman, J. M., Stellman, S. D., & Sommer, J. F. (2003). Risk factors for course of posttraumatic stress disorder among Vietnam veterans: A 14-year follow-up of American Legionnaires. *Journal of Consulting and Clinical Psychology*, 71, 980–986.
- Larson, G. E., Highfill-McRoy, R. M., & Booth-Kewley, S. (2008). Psychiatric diagnoses in historic and contemporary military cohorts: Combat deployment and the healthy warrior effect. *American Journal of Epidemiology*, 167, 1269–1276.
- Litz, B. T., King, L. A., King, D. Q., Orsillo, S. M., & Friedman, M. J. (1997). Warriors as peacekeepers: Features of the Somalia experiences and PTSD. *Journal of Consulting and Clinical Psychology*, 65, 1001–1010.
- Litz, B. T., Orsillo, S. M., Friedman, M., Ehlich, P., & Batres, A. (1997). Posttraumatic stress disorder associated with peacekeeping duty in Somalia for U.S. military personnel. *American Journal of Psychiatry*, 154, 178–184.
- Mental Health Advisory Team (MHAT). (2008). *Mental Health Advisory Team (MHAT-V) Report: Operation Iraqi Freedom 06-08: Iraq; Operation Enduring Freedom 8: Afghanistan*. Washington, DC: Office of the Surgeon Multi-National Force-Iraq, Office of the Command Surgeon, and Office of the Surgeon General United States Army Medical Command.
- Milliken, C. S., Auchterlonie, J. L., & Hoge, C. W. (2007). Longitudinal assessment of mental health and reserve component soldiers returning from the Iraq War. *Journal of the American Medical Association*, 298, 2141–2148.
- Norris, F. H., & Uhl, G. A. (1993). Chronic stress as a mediator of acute stress: The case of Hurricane Hugo. *Journal of Applied Social Psychology*, 23, 1263–1284.
- Ruggiero, K. J., Del Ben, K., Scotti, J. R., & Rabalais, A. E. (2003). Psychometric properties of the PTSD Checklist-Civilian Version. *Journal of Traumatic Stress*, 16, 495–502.
- Simon, R. W. (2002). Revisiting the relationships among gender, marital status, and mental health. *American Journal of Sociology*, 107, 1065–1096.
- Smith, T. C., Ryan, M. A. K., Wingard, D. L., Slymen, D. J., Sallis, J. F., & Kritzer-Silverstein, D. (2008). New onset and persistent symptoms of post-traumatic stress disorder self reported after deployment and combat exposures: Prospective population based U.S. military cohort study. *British Medical Journal*, 336, 366–376.
- Southwick, S. M., Morgan, C. A., Darnell, A., Bremner, D., Nicolaou, A. L., Nagy, L. M., et al. (1995). Trauma-related symptoms in veterans of Operation Desert Storm: A 2-year follow-up. *American Journal of Psychiatry*, 152, 1150–1155.
- SPSS Inc. (2008). *SPSS for Windows (Version 16)* [Computer software]. Chicago, IL: Author.
- Sutker, P. B., Davis, J. M., Uddo, M., & Ditta, S. R. (1995). War zone stress, personal resources, and PTSD in Persian Gulf War returnees. *Journal of Abnormal Psychology*, 104, 444–452.
- Vogt, D. S., Pless, A. P., King, L. A., & King, D. W. (2005). Deployment stressors, gender, and mental health outcomes among Gulf War I veterans. *Journal of Traumatic Stress*, 18, 115–127.
- Vogt, D. S., Samper, R. E., King, D. W., King, L. A., & Martin, J. A. (2008). Deployment stressors and posttraumatic stress symptomatology: Comparing active duty and National Guard/Reserve personnel from Gulf War I. *Journal of Traumatic Stress*, 21, 66–74.
- Weathers, F. W., Litz, B. T., Herman, D. S., Huska, J. A., & Keane, T. M. (1993, October). The PTSD Checklist: Reliability, validity and diagnostic utility. Paper presented at the annual meeting of the International Society for Traumatic Stress Studies, San Antonio, TX.
- Wolfe, J., Brown, P., & Kelly, J. M. (1993). Reassessing war stress: Exposure and the Persian Gulf War. *Journal of Social Issues*, 49, 15–31.
- Wright, K. M., Marlowe, D. H., Martin, J. A., Gifford, R. K., Belenky, G. K., & Manning, F. J. (1995). *Operation Desert Shield/Desert Storm: A summary report*. Washington, DC: Walter Reed Army Institute of Research.

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14. ABSTRACT The effect of combat and operational stress on the mental health of military personnel is a major concern. The objective of this study was to identify factors associated with possible posttraumatic stress disorder (PTSD). A questionnaire was completed by a sample of 1,569 Marines who had deployed to combat in support of the current conflicts in Iraq and Afghanistan (2002-2007). Using the PTSD Checklist, 10.6% of the sample screened positive for possible PTSD. Of 10 demographic and psychosocial factors that were examined in relation to possible PTSD, four factors were significant in a multivariate analysis: deployment-related stressors, combat exposure, mild traumatic brain injury symptoms, and marital status. Deployment-related stressors had a stronger association with possible PTSD than any other variable in the study. Deployment-related stressors are potentially modifiable, such as by improving support to families, and improving access and options for communication with home.					
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